Alpha-Gamma Hot Cell Facility

Argonne's Alpha-Gamma Hot Cell Facility (AGHCF) is equipped to handle and analyze irradiated nuclear fuel and other radioactive materials. The facility was designed and built to conduct postirradiation examination of fuels and structural components for reactor development, and that role has expanded over the years to include analysis and testing of components for current reactors. The research has helped in the development of safe and reliable fuel systems for advanced commercial power reactors and research reactors; the latter development led to an IR-100 award. The facility has also provided information for the safe future handling of irradiated materials by characterizing spent nuclear fuel from the Department of Energy inventory so that safe methods for their treatment or internment can be identified.

The AGHCF consists of a high-purity-nitrogen-atmosphere, multiroom, kilocurie hot cell; an air cell called the Clean Transfer Area (CTA); an Electron Beam Laboratory that contains a scanning electron microscope (SEM), an electron microprobe (EMP), and a scanning auger microprobe (SAM); shielded gloveboxes and a contaminated materials laboratory for preparation of lightly radioactive or contaminated materials; a machine shop; and supporting equipment areas.

View of front of hot cell

Hot Cell Equipment

- Ten manipulator-equipped workstations.
- Handling of samples up to 6 ft long and 4 in. in diameter, or larger by special arrangement.
- Equipment for handling shipping containers up to 10 tons; vertical containers up to 5 ft tall can be accommodated.
- Macrocameras for magnification from 1X to 20X.
- Gamma spectroscopy (Ge detector) with computerized data collection with a 4096-channel pulse-height analyzer.
- Contact profilometer, contact micrometers, and dial-gauge micrometers.
- Fission-gas collection and analysis.
- Remotely operated cutoff machine and metallography/ceramography equipment.
- Leitz metallograph with microhardness indenter.
- Density measurement apparatus.
- High-temperature computer-controlled furnaces (radiant and resistance), for controlled heating cycles up to 1400°C, with fission gas collection and video imaging capability.

Ancillary Equipment

- Charmille Andrew Electric Discharge Wire-Cutting Machine (EDM) for machining mechanical-test specimens. The EDM can be operated in the CTA and is capable of machining irradiated specimens to within 0.0005 in.

- Instron tensile machines capable of both tension and compression tests. A screw-driven Instron TT and a servo-hydraulic Instron 8511 can be operated in the CTA.
- LECO Model RH-404 Hydrogen Determinator for analyzing elemental hydrogen. Capability for analyzing specimens with up to 250 μg of hydrogen at a precision of ±0.01 ppm. Analysis of radioactive specimens is available.
- Z-Mike Model 2100 Dimensional Measurement System for length measurements to $\pm 2 \times 10^{-6}$ in.

Electron Beam Laboratory

- Shielded gloveboxes with metallographic specimen preparation equipment.
- Gold coater for preparing nonconductive contaminated specimens for electron beam analysis.
- Additional support gloveboxes.

Scanning Electron Microscope

- ETEC Model U1 SEM with IXRF Mostek window for light-element detection (Li and above).
- Computer-based energy-dispersive spectral analysis.
- Digital photography and dot maps for spatial elemental distribution.
- Analysis of specimens up to on-contact readings of ≤10 R/h, 1 in. diameter and 0.75 in. high.

Auger Microprobe

- JEOL Model JAMP-10 SAM.
- Computer-based analysis.
- Specimens in Auger up to on-contact readings of ≤10 R/h and 1 in. diameter and 0.5 in. high.
- Element identification and quantification by cylindrical mass analyzer capable of identifying elements above helium (Z = 2).

Shielded Electron Microprobe

- MAC-450 EMP with wavelength-dispersive spectral (WDS) analysis capability.
- Analysis of full-size (1.25 in.) metallographic specimens of irradiated fuel and materials.
- EMP column, shielded by a tungsten alloy, can handle any metallographic specimen pneumatically transferred from the hot cell.
- Element identification and quantification of all elements above neon (Z = 10).
- WDS analysis is least affected by specimen radioactivity and thus provides best quantification information.

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